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SUPPLEMENT TO THE VOLUME

LOCOMOTIVE APPLIANCES

OF

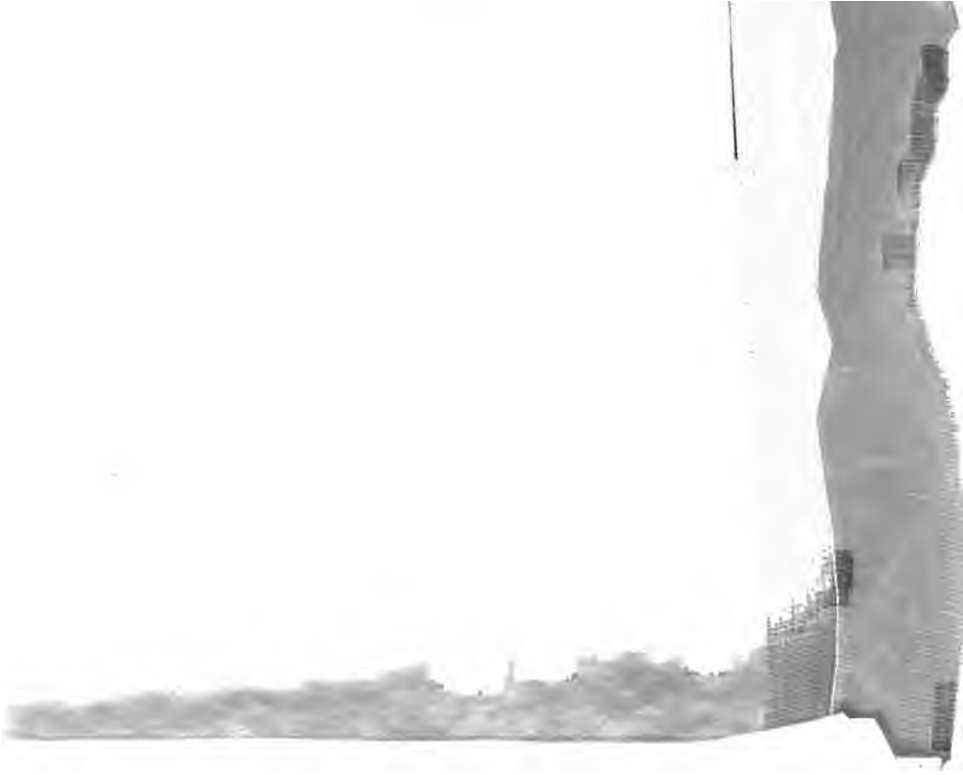
THE SCIENCE OF RAILWAYS

BY

MARSHALL M. KIRKMAN

EMBODYING DESCRIPTION
OF
SOUTHERN LOCOMOTIVE VALVE GEAR
RAGONNET POWER REVERSING GEAR
MELLIN POWER REVERSING GEAR

CHICAGO
CROPLEY PHILLIPS COMPANY
1915



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SOUTHERN LOCOMOTIVE VALVE GEAR

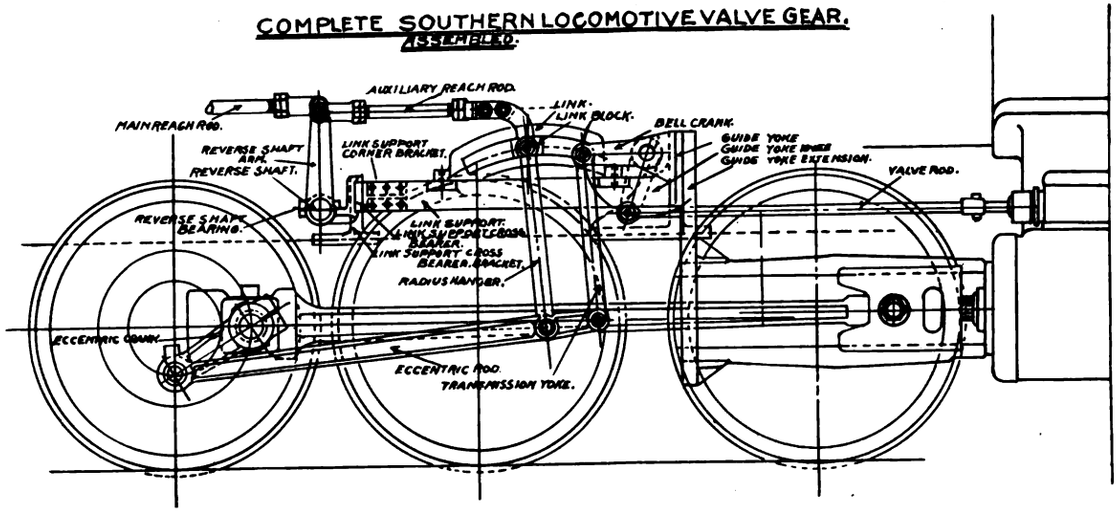
While it is a radical departure from all previous outside gears, it is a gear that can be adapted to any class of locomotives, both inside and outside admission, and is designed with the view of eliminating roundhouse repairs and delays to power incident thereto. It is a well known fact that there is a derangement in the valve movement on all outside radial gears, due to the change in the angularity of the main rod as the engine settles. This valve gear has been so designed as to practically eliminate this objectionable feature.

Transferring from a rotary motion to a reciprocating motion is accomplished by direct movements and on straight lines, doing away with strains and distortions found in other valve gears in common use today. The links being located in a horizontal position and being stationary, entirely does away with wear at this point, as the block only moves in the link when the reverse lever is moved to adjust cut-off or reverse gear. The link being stationary also eliminates what is known as the slip in the link block, found in some outside gears. There are but eight possible points of wear on each side of an engine or a total of sixteen points of wear per locomotive, this being less than half contained in other gears.

This gear will practically do away with engine failures due to breakage of valve gear parts. The different parts are so balanced as to reduce the wear on the pins and bushings to a minimum. The forward end of the eccentric rod is supported by bell crank hanger, which has at its top two bearings spaced widely apart, thus absolutely preventing any side slap on eccentric rod.

This valve gear is designed to eliminate all stress and strains on reverse lever and reach rod connections. The reverse lever is easily handled with one hand while engine is working under full steam pressure. This feature appeals very strongly to the engineer as it enables him to adjust his cut-off without fear of the reverse lever getting away from him and will induce him to work as short cut-off as possible, resulting in the saving of fuel. This valve gear will stand hard usage that it is bound to get under heavy freight service, as has been proven in a series of dynamometer car tests.

COMPLETE SOUTHERN LOCOMOTIVE VALVE GEAR.
ASSEMBLED.



Directions for Setting and Adjusting Southern Locomotive Valve Gear.—The dead centers are found in the usual way, and the valve gear assembled according to elevation, with eccentric crank of proper length and set so that the pin travels in an 18-inch circle and the reverse shaft arms stand vertical while the reverse lever is in center position of quadrant and the link set in position shown on the elevation, and securely clamped; also that the auxiliary reach rods have been adjusted to bring the link block in the center of the link while the reverse lever is in middle position.

Diagram No. 1 shows an ideal valve gear, with all parts of proper dimensions and properly located and adjusted. This gear will have a uniform lead at both front and back ports.

Full lines show the position of eccentric crank for outside admission, and dotted lines show the same for inside admission.

For outside admission, the eccentric crank leads the main crank pin, but for inside admission, it follows the main crank pin.

Diagram No. 2 shows a derangement of valve gear caused by a long eccentric crank. A long eccentric crank pulls the radius hanger center "D" back to "E" while engine is on forward dead center, and thrusts same forward to "F" when engine is on back dead center. This increases the lead in forward motion, and decreases the lead in back motion.

Although the eccentric crank be of correct length, the same derangement will occur if eccentric pin does not have a full travel of 18 inches; a short eccentric crank, or one having more than 18 inches travel, will have just the opposite effect to that caused by the first case, viz: the lead will be decreased in forward motion and increased in back motion. The effect for inside admission is just the opposite in both cases.

Diagram No. 3 shows the method of correcting derangement shown on diagram No. 2. First test full travel of center "D" as follows: take a tram "T" of sufficient length; place one leg in center "D1", and with the other leg "d1" scribe arc "C". While main crank pin is passing through bottom quarter, eccentric crank will pass through position shown on the diagram, and this will give the extreme travel of the center "D" back.

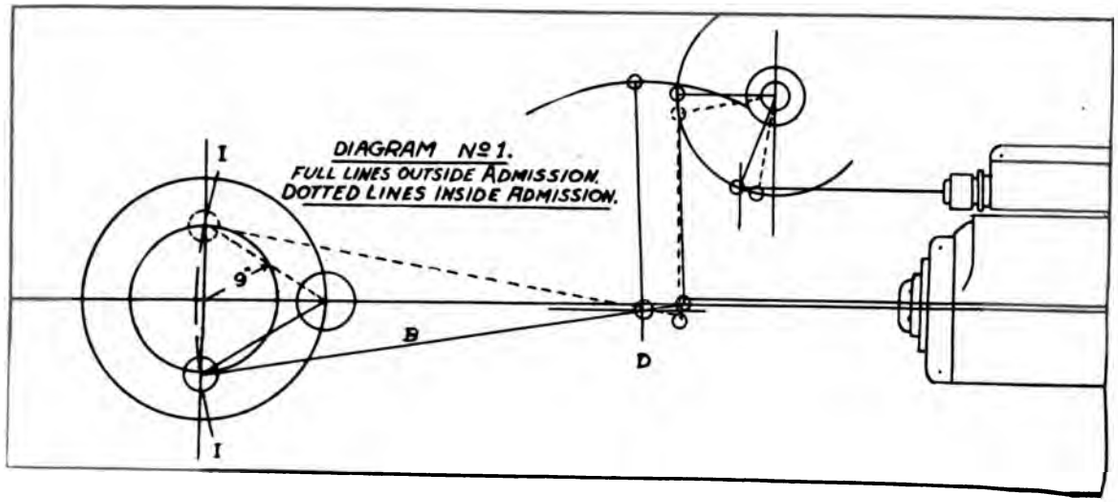


DIAGRAM Nº 1.
FULL LINES OUTSIDE ADMISSION.
DOTTED LINES INSIDE ADMISSION.
I
9"
B
D
I

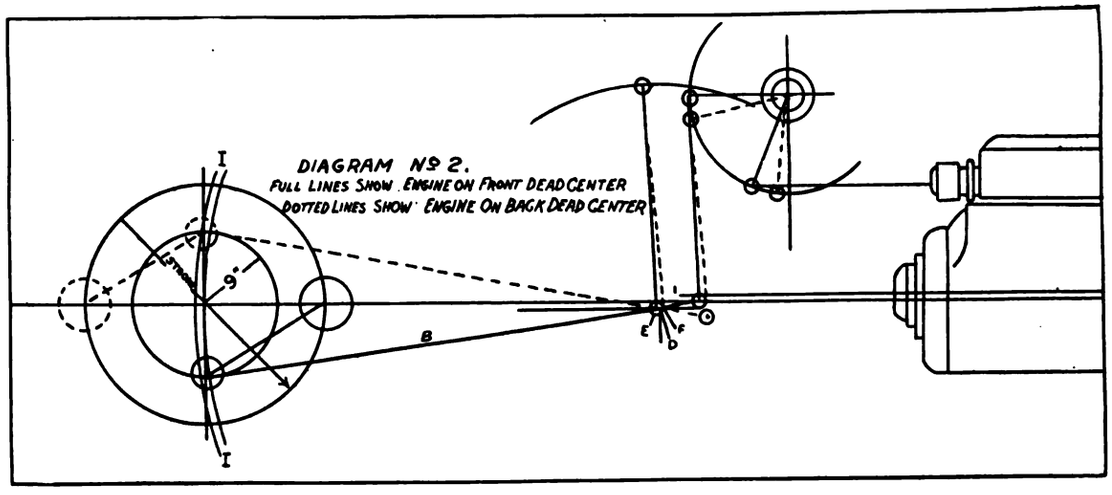


DIAGRAM Nº 2.
FULL LINES SHOW ENGINE ON FRONT DEAD CENTER
DOTTED LINES SHOW ENGINE ON BACK DEAD CENTER
I
I
9"
B
E
F
D

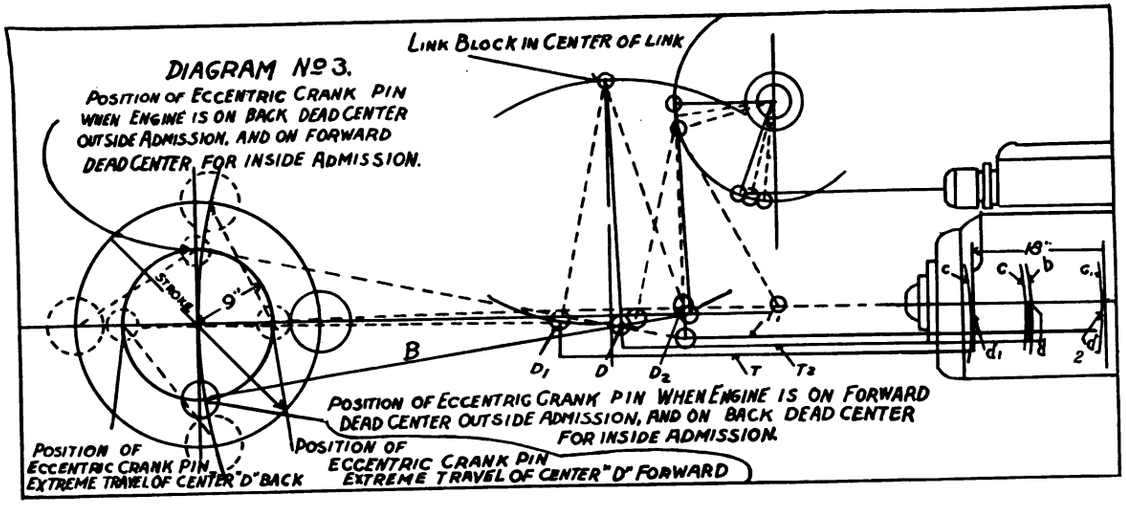
Then with the same tram "T1", with leg in center "D" with the other leg "d2", scribe an arc "C1", while engine is passing through top quarter and eccentric crank is passing through position shown on diagram. This will give the extreme travel forward of the center "D". If the distance between the arcs "c" and "c1" measures 18 inches, the travel of the center "D" is correct; if more or less than 18 inches, move the eccentric crank pin inward or outward the necessary amount to secure 18 inches travel. Then try for correct length of eccentric arm as follows: Set engine on forward dead center and with tram "T2", one leg in center "D", with the other leg "d1" scribe an arc as shown, say the center arc between "a" and "b", then turn engine over on back dead center and with one leg of tram "T2" in center "D" as before, scribe another arc; if this arc comes line in line with the first center arc, the eccentric crank is O. K. But if the first arc, scribed while engine was on forward dead center should fall at "a" and the second arc, scribed while engine was on back dead center should fall at "b", for outside admission this would show that the eccentric crank was too long and would have to be shortened about one-fourth the difference between arcs "a" and "b"; also the eccentric pin would have to be moved away from the center of main axle in order to secure full travel of 18 inches of center "D".

If the first arc, scribed while engine was on forward dead center, should fall at "b", and the second arc, scribed while engine was on back dead center, should fall at "a", for outside admission this would show that the eccentric crank was too short, and it would have to be lengthened about one-fourth the difference between arcs "a" and "b" and eccentric pin moved in toward main axle to obtain 18 inches travel of center "D".

Of course, for inside admission, the reverse process would have to be followed for lengthening and shortening the eccentric crank. Diagram No. 4 shows the valve gear with a properly located link; the names of the different parts of the gear are also shown.

Diagram No. 5 shows the effect of link being improperly set, with the link too far ahead and engine on either center. When link is moved forward, the valve will be pulled back; when the link is too far back and the link block moved for-

r "D" grive is passing xtreme en the center eccen- unt to eccen- er and g "d" " and h one arc; if entric e was d arc all at entric one- eccen- main "D". dead hile side too the ved "D". ble are



ward, the valve will be pushed ahead. *Remedy:* If the valve moves in the same direction as the link block, move the link forward; if the valve moves in opposite direction to the link block, move the link back until a position is found where the link block can be moved full sweep in the link when engine is on either dead center without moving the valve. Then drill the eight holes in link support and bolt the link down.

Then try cut-off and make changes in valve rods to square cut-off. If the valves are reported out after engine has been in service several months, raise links by applying liners under both ends of links, which will remedy the trouble.

NOTE: An ideal steam distribution cannot be obtained without first having an engine with the crank pins correctly quartered and main crank (or stroke) the exact length. Any variation in one or both of these points will cause a derangement in the movement of the valve.

In case elevation shows a less or greater circle than 18 inches for eccentric crank pin to scribe, it will be necessary to set eccentric crank to scribe circle shown on elevation..

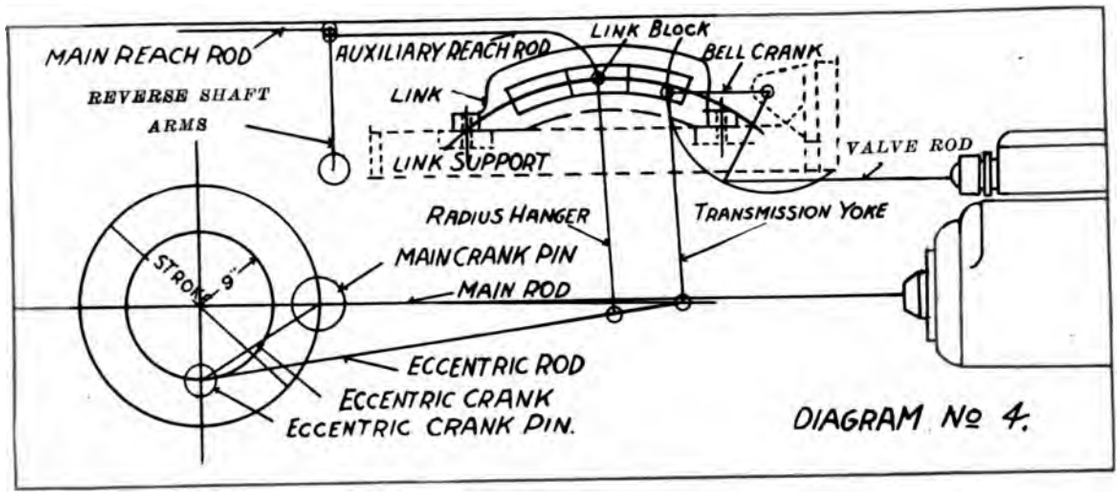
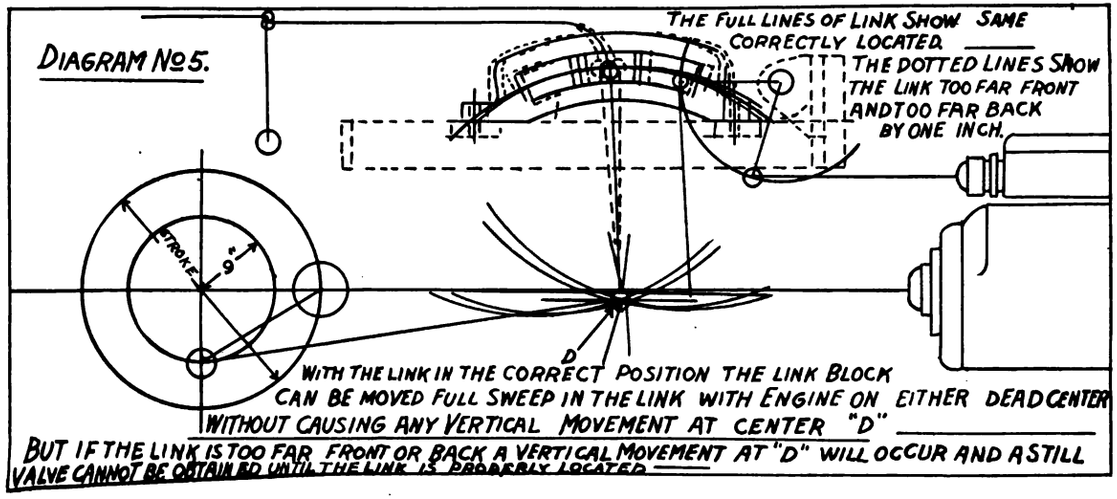

MAIN REACH ROD
AUXILIARY REACH ROD
LINK BLOCK
BELL CRANK
REVERSE SHAFT
ARMS
LINK
LINK SUPPORT
VALVE ROD
RADIUS HANGER
TRANSMISSION YOKE
MAIN CRANK PIN
MAIN ROD
STROKE 9"
ECCENTRIC ROD
ECCENTRIC CRANK
ECCENTRIC CRANK PIN.
DIAGRAM No 4.

DIAGRAM No 5.



WITH THE LINK IN THE CORRECT POSITION THE LINK BLOCK CAN BE MOVED FULL SWEEP IN THE LINK WITH ENGINE ON EITHER DEAD CENTER WITHOUT CAUSING ANY VERTICAL MOVEMENT AT CENTER "D"

BUT IF THE LINK IS TOO FAR FRONT OR BACK A VERTICAL MOVEMENT AT "D" WILL OCCUR AND A STILL VALVE CANNOT BE OBTAINED UNTIL THE LINK IS PROPERLY LOCATED.

RAGONNET POWER REVERSING GEAR

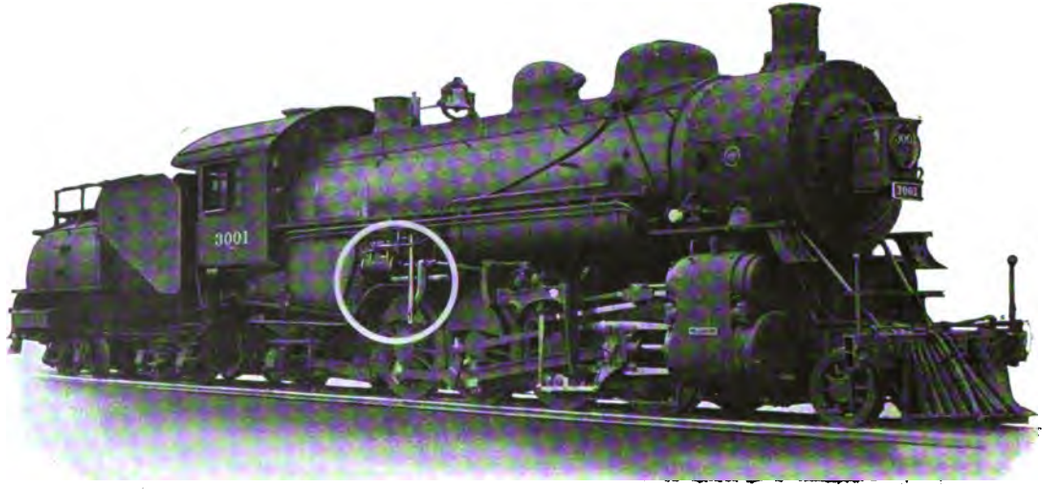
The power reverse has come to be recognized as almost a necessity on the heavy locomotives now in common use.

The difficulty, not to say danger, in hooking up passenger engines while running at high speed, may lead to the practice of controlling the engine by throttling instead of by the cut-off, which is not conducive to economy. The power reverse, making it easy and safe to alter the cut-off while running at the highest speed, is thus a great factor in the economical use of steam.

The power reverse is also coming into use for switching engines, both heavy and light, on account of the great increase in capacity made possible by the easy handling of the reverse lever. On switch engines with ordinary hand lever the day's work is frequently limited by the engineer's ability to withstand the fatigue incident to the constant handling of the lever. Thus the power reverse has been the means of greatly increasing the capacity of switching engines.

The accompanying illustrations represent a well known power reverse gear, the invention of Mr. E. L. Ragonnet. This device has passed through the experimental stage and is presented as a thoroughly practical solution of the power reverse gear problem.

The gear is preferably operated by air, although an auxiliary steam connection is provided. Distribution is controlled by an ordinary D slide valve arranged for outside admission. The piston rod is connected to a crosshead, which is coupled to the reverse shaft by means of a suitable reach rod. The crosshead gibs are held in place by a cast steel plate having an arm projecting downwards. This crosshead arm is connected by a suitable link with the lower end of a floating lever. The upper end of this floating lever is pivotly connected to, and



Ragonnet Power Reverse Gear

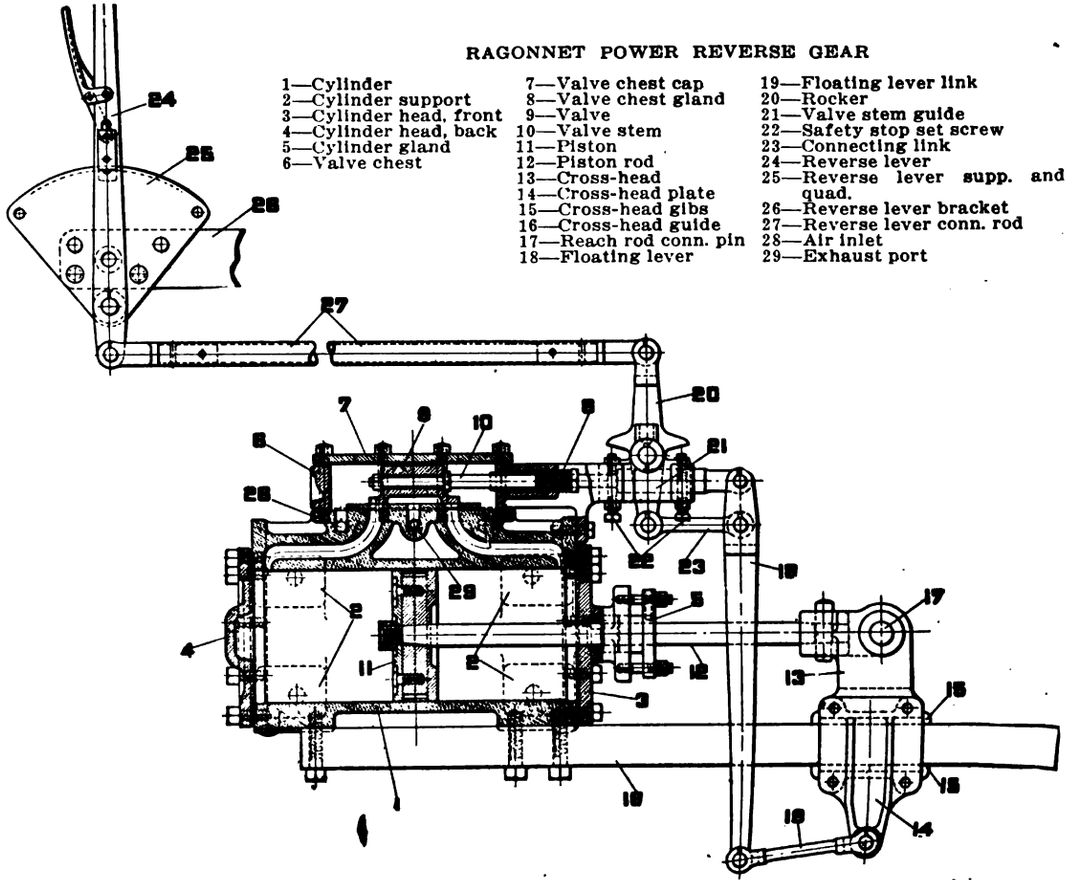
supported by the valve stem, which in turn is carried by a cylindrical guide. Through the agency of a rocker, the upper end of which is connected by a light rod with a small reverse lever, and the lower end through a link with the floating lever a short distance below the valve stem, the movement of the valve is controlled from the cab. The rocker is provided with tappets which strike the ends of projecting set screws when the limit of travel of the valve is reached. These set screws require no adjustment after the gear is properly applied, and merely limit the throw of the reverse shaft arm in either direction.

The small reverse lever is locked in any desired position by an ordinary toothed quadrant. Assuming the lever in mid position and the valve normally covering both ports; when the lever is moved into forward gear (to the right, referring to the drawing) the floating lever swings about its lower end as a fulcrum, and the slide valve is moved to the right, admitting air to the left-hand end of the cylinder. The piston now moves to the right, and the floating lever, pivoting about its intermediate, or reverse-lever connection, returns the valve to its central position unless the progressive movement of the reverse lever is continued. Thus it will be seen that when the lever is shifted to any desired location, the piston moves in the proper direction until the valve gear reaches a corresponding point, whereupon the valve is automatically returned to its central, or lapped position.

Since the exhaust, or inside lap of the valve is materially greater than the outside lap (which is very small) air is held on both sides of the piston at the same time. It will thus be seen that the mechanism is prevented from creeping or vibrating by an elastic cushion formed by compressing the air in one end of the cylinder or the other. In no case does the valve open to exhaust when holding the gear in any desired cut-off position. Owing to this arrangement the gear is very economical of air—in fact, when piston and piston-rod packing are properly maintained, the loss of air, when holding the valve gear in a fixed position, is practically nil. The holding of the valve gear through the medium of an air cushion instead of by a rigid latch and quadrant, materially

RAGONNET POWER REVERSE GEAR

1—Cylinder
2—Cylinder support
3—Cylinder head, front
4—Cylinder head, back
5—Cylinder gland
6—Valve chest
7—Valve chest cap
8—Valve chest gland
9—Valve
10—Valve stem
11—Piston
12—Piston rod
13—Cross-head
14—Cross-head plate
15—Cross-head gibs
16—Cross-head guide
17—Reach rod conn. pin
18—Floating lever
19—Floating lever link
20—Rocker
21—Valve stem guide
22—Safety stop set screw
23—Connecting link
24—Reverse lever
25—Reverse lever supp. and quad.
26—Reverse lever bracket
27—Reverse lever conn. rod
28—Air inlet
29—Exhaust port



lessens the wear and tear of the valve gear and its connections.

The cylinder is oiled through a small lubricator, conveniently placed in the cab, and suitable means of lubrication are provided on all moving parts.

The entire mechanism is so simple in construction, and has proved so reliable in service, that, as a rule, no auxiliary hand gear of any description is applied.

MELLIN POWER REVERSING GEAR

A power reversing gear is generally applied to Mallet and heavy Mikado locomotives to operate the reverse lever. This device consists of an engine of two cylinders, one for air and the other filled with oil. The two cylinders are set one ahead of the other, the pistons being mounted on a common piston rod connected either directly or indirectly to the main reverse lever.

The arrangement and construction of this mechanism is shown in Fig. 1 on the following page. In this case, the forward one is the air cylinder.

The pistons of both cylinders are provided with leather packing, that in the air cylinder being held out by spring rings. The cylinders are operated by conical valves, the construction of which is shown in the detail illustration.

These valves are operated through a connecting rod by an auxiliary lever (R) pivoted on the main lever (Q).

By an interlocking arrangement, the latch of the main reverse lever is loosed by raising that of the auxiliary lever and cannot drop until the two levers are in their normal position to each other.

Ordinarily, the valve motion is handled entirely by the auxiliary reverse lever. Consequently, the main reverse lever is usually not brought above the deck of the cab, thus leaving more room for the engineer. A separate handle, easily attached, is provided for the main lever for use in case of emergency.

The auxiliary lever is handled exactly the same as the main reverse lever would be except that of itself it only has

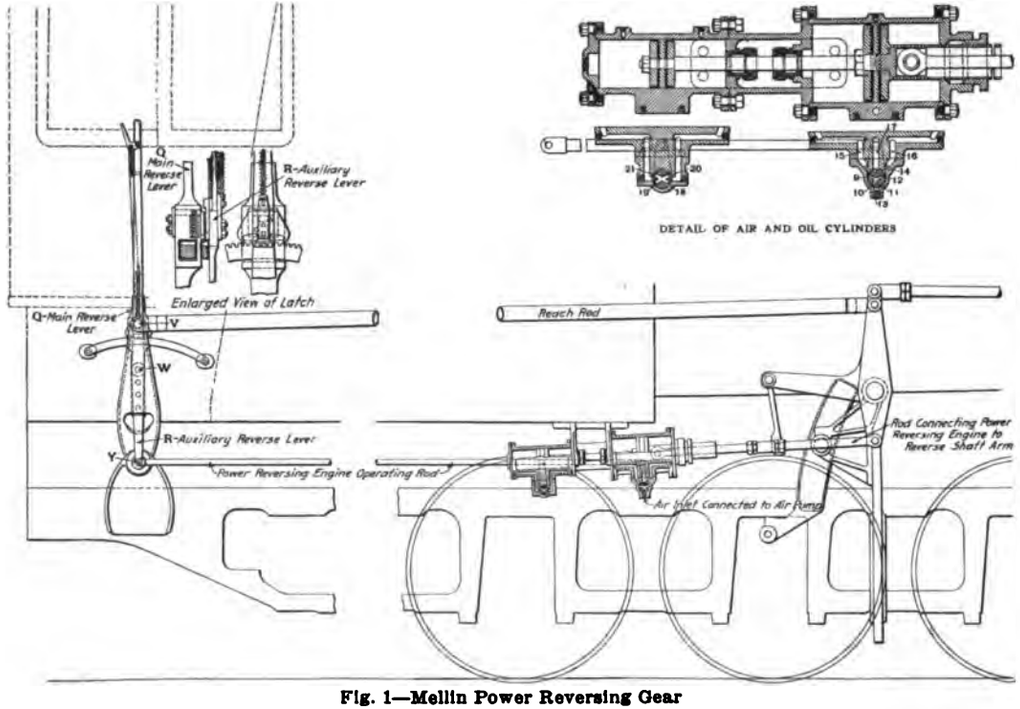


Fig. 1—Mellin Power Reversing Gear

a limited throw about its pivot point on the latter. This slight movement operates the valves in the reversing engine and the valve motion is moved in the desired direction. When the required notch in the quadrant is reached and the auxiliary lever latched, the gear automatically restores the main reverse lever to its normal position relative to the former. This permits the main lever to engage with its quadrant and also closes the valves of the reversing engine, thus giving both a positive and an oil lock to the gear.

The oil cylinder prevents the too rapid movement of the reversing gear when a change of cut-off is made. It is imperative, therefore, that the engineer should see that this cylinder is always kept full of oil. The frequency with which it should be filled depends on the condition of its piston and piston-rod packing, and these should therefore be kept in good repair. If the reversing gear operates too rapidly, this indicates that the oil cylinder needs refilling, and this should be done, and any leakages stopped as soon as possible.

After any overhauling of the reversing engine, particular care should be exercised to see that the valves are properly set so that the valve openings and cylinder ports match up correctly.

If the power reversing gear fails to operate when the valves are supposedly opened and nothing has happened to the air supply, first examine the valves to see that they are in their proper position.

If the main lever does not latch properly, which might happen because of lost motion in the gear after long service or because of improper adjustment in setting up the gear after repairs, the engineer should report this matter at once. Under such a condition, the latch of the auxiliary lever would have to resist any pull that comes on the levers with the result that it would wear more quickly.

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